Bullards Fire Restoration Invasive Species Treatments Project

Hydrology and Soils Report

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Table of Contents

Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction 1
Affects Analysis 3
Geographic and Temporal Bounds 3
Hydrology and Soil Effects Methodology 3
Cumulative Watershed Effects Methodology 4
Hydrology and Soil Effects Data Sources 4
Affected Environment 4
Environmental Consequences 5
Alternative A-Proposed Action 5
Treatment within RCAs and SMZs 5
Project Design Features 6
Hydrology (Water Resources) 7
Alternative A-Proposed Action 7
Direct and Indirect Effects of Manual Treatments 7
Cumulative Effects of Manual Treatments 8
Direct and Indirect Effects of Chemical Treatments 8
Cumulative Watershed Affects Analysis 10
Alternative B-No Action 14
Direct and Indirect Effects of Manual Treatments 14
Cumulative Effects of Manual Treatments 14
Direct and Indirect Effects of Chemical Treatments 14
Cumulative Watershed Affects Analysis 14
Soils 14
Alternative A-Proposed Action 14
Direct and Indirect Effects of Manual Treatments 14
Cumulative Effects of Manual Treatments 15
Direct and Indirect Effects of Chemical Treatments 15
Cumulative Effects of Chemical Treatments 16
Alternative B-No Action 16
Direct and Indirect Effects of Manual Treatments 16
Cumulative Effects of Manual Treatments 17
Direct and Indirect Effects of Chemical Treatments 17

Cumulative Effects of Chemical Treatments 17
Compliance with the Forest Plan and Other Direction 17
References Cited 19

Hydrology and Soils

Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Bullards Fire Restoration Invasive Species Treatments Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, b). Management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USDA 2004a, b).

Clean Water Act – Establishes as federal policy the control of both point and non-point pollution and assigns to the States the primary responsibility for control of water pollution. The basis of the Clean Water Act was enacted in 1948 and was called the Federal Water Pollution Control Act. In 1972 the Act was significantly reorganized and expanded which become commonly known as the Clean Water Act.

Section 303(d) of the Clean Water Act - Requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards or are considered impaired. The list of affected water bodies, and associated pollutants or stressors, is provided by the State Water Resources Control Board (SWRCB). The most current list available is the 2012 Integrated Report on the SWRCB website (SWRCB 2012). The North Yuba River is listed for mercury. The proposed activities are not expecting to contribute to total maximum daily loads (TMDLs) for mercury.

State Water Quality Management Plan – From 2000 until 2011, non-point source pollution on Plumas National Forest was managed through the water quality management program contained in Water Quality Management for Forest System Lands in California (USDA, 2000). The Best Management Practices (BMPs) contained in that document have recently been improved and replaced by the BMPs presented in a Region 5 amendment to the Forest Service Handbook (see below). The 2000 State Water Quality Management Plan contains the 1981 Management Agency Agreement (MAA) between the California State Water Resources Control Board and the USDA, Forest Service. The State Board has designated the Forest Service as the management agency for all activities on National Forest lands.

Region 5 2011 Amendment to the Forest Service Soil and Water Conservation Handbook - The Pacific Southwest Region (Region 5) of USDA-Forest Service has recently adopted an amendment to the Forest Service Handbook, Section 2509.22, Chapter 10 (Water Quality Management Handbook) (USDA Forest Service 2011). This handbook improves and replaces the Best Management Practices presented in Water Quality Management for Forest System Lands in California (see above). The Forest Service water quality protection program relies on implementation of BMPs. Best Management Practices are procedures, techniques, and design features that are incorporated in project actions that have been determined by the State of California to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

National Best Management Practices – In 2012 the National Core BMPs were established for water quality management on National Forest System Lands. The BMPs applicable to this project are the ones identified under the chemical use management activities (Chem-1 to Chem-6).

Beneficial Uses Identified by the CA Regional Water Quality Control Board (Central Valley Region) - Beneficial uses are defined under California State law in order to protect against degradation of water resources and to meet state water quality objectives. The Forest Service is required to protect and enhance existing and potential beneficial uses (California Regional Water Quality Control Board [CRWQCB] 1998). Beneficial uses of surface water bodies that may be affected by activities on the Forest are listed in Chapter 2 of the Central Valley Region's Water Quality Control Plan (commonly referred to as the "Basin Plan") for the Sacramento and San Joaquin River basins (CRWQCB 1998). The beneficial uses identified will be associated to Englebright Reservoir.

National Forest Management Act – The National Forest Management Act (NFMA) of 1976 amended the Forest and Rangeland Renewable Resources Planning Act of 1974. This authority requires the maintenance of productivity of the land and the protection and, where appropriate, the improvement of the quality of soil and water resources. The Act specifies that substantial and permanent impairment of productivity must be avoided.

Plumas National Forest Land and Resource Management Plan (LRMP) - Forest Plan standards and guidelines provide the relevant substantive standards to comply with NFMA. The 1988 LRMP (USDA 1988) establishes standards and guidelines for protection and maintenance of Forest watersheds, water quality, and water supply, including:

- Implementation of BMPs.
- Establishment of Streamside Management Zones (SMZs) per guidelines in Appendix M of the LRMP. These guidelines were replaced by the standards and guidelines presented in the SNFPA ROD.
- Preparation of an SMZ plan for any activities that will occur within an SMZ, including a description of vegetation management objectives, needed erosion control measures, and an analysis of SMZ areas with over-steepened slopes or very high Erosion Hazard Rating (EHR). The SMZ plan for this project is included in project file.

The Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD) -

The SNFPA ROD (USDA 2004) describes management direction for riparian areas and water resources located on Plumas National Forest System lands. The ROD includes six riparian conservation objectives (RCOs) and more than thirty standards and guidelines to be implemented for designated Riparian Conservation Areas (RCAs). Designation of appropriate widths of RCAs is an integral element of the riparian area management. The standard and guide for Riparian Conservation Area (RCA) widths suggested by the ROD are described below. RCA widths shown below may be adjusted at the project level if a landscape analysis has been completed and a site-specific Riparian Conservation Objectives (RCO) analysis demonstrates a need for different widths which did occur for this project. For more specifics on these two analyses see the appendix. The adjusted widths are listed and described in the "Treatment within RCAs and SMZs" section below.

- Perennial Streams: 300 feet on each side of the stream, measured from the bank full edge of the stream
- Seasonally Flowing Streams (includes intermittent and ephemeral streams): 150 feet on each side of the stream, measured from the bank full edge of the stream
- Streams in Inner Gorge: top of inner gorge

- Special Aquatic Features or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank: 300 feet from edge of feature or riparian vegetation, whichever width is greater
- Special Aquatic Features include: lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs
- Other hydrological or topographic depressions without a defined channel: RCA width and protection measures determined through project level analysis.

Affects Analysis

Geographic and Temporal Bounds

The geographic area examined for direct and indirect effects is at the proposed project treatment area scale. This 24 acre analysis area is identified in this document as the "project analysis area" which is an old quarry site. The project analysis area is at an elevation of approximately 2,400 feet and access to the site is via the Marysville Road. The timespan of the invasive species treatment would be ten years. For short-term effects, temporal scope can range from hours to months post treatment.

The geographic area examined for cumulative effects is at the project delineated subwatershed scale. This area identified in the document as the "watershed analysis area" is 1,186 acres and is just below New Bullards Bar Reservoir. Given the temporal limitations related to the half-life for these herbicides, examining treatment on an annual basis is an adequate temporal bound for cumulative effects.

Hydrology and Soil Effects Methodology

The analysis methodology is designed to examine potential direct, indirect, and cumulative effects from proposed manual and chemical treatments to soil and water resources. This analysis takes into account the setting, exiting conditions, and past, present and future activities that may lead to cumulative effects. The proposed manual treatment are small in scale pose negligible risk to soil and water resources. Chemical treatments would have more potential for risk and are more complicate to quantify, so these treatments are the focus of our analysis. Direct application to water is not proposed, so special attention is paid to direct effects to soils and the possibility of herbicide moving to water bodies from treatment sites.

The Forest Service has a contract with Syracuse Environmental Research Associates, Inc. (SERA) to conduct human health and ecological risk assessments. These assessments are for herbicides that may be proposed for use on National Forest System lands. The information contained in this analysis relies on these risk assessments. Herbicide effects to relevant resources were analyzed in risk assessments for each of the eight herbicides included in the proposed action (SERA 2004a, 2004b, 2007, 2011a, 2011b, 2011c, 2012, 2014). The risk assessments considered worst-case scenarios including accidental exposures and application at maximum reported rates. Although the risk assessments have limitations, they represent the best science available.

The GLEAMS (Groundwater Loading Effects of Agricultural Management Systems) model examines the fate of herbicides in various soils under a variety of environmental conditions (SERA 2013). This model was used for all the Forest Service SERA risk assessments. This is a well-validated model for herbicide transport and is the best available at this time.

Other projects on the Plumas National Forest that proposed the use of herbicides ran the GLEAMS model. These projects are the Rush Skeleton Weed Project 2016, PG&E Herbicide Vegetation Management Program Transmission Line Right-of-Ways 2015, and Storrie and Rich Fire Areas Invasive Plant Treatment Project 2015. The GLEAMS model was not run for this project because the lack of live streams (perennial and intermittent) in the project area lowered the potential for the proposed chemicals to reach the ephemeral stream. Instead the project will rely on use published literature, SERA risk assessments, forest literature, and Forest Service monitoring reports to develop design features and monitoring plans to minimize any impact to water quality.

Cumulative Watershed Effects Methodology

Potential cumulative effects from past, present, and future projects are considered for most project analysis using the Equivalent Roaded Acre (ERA) Model in Region 5 (Region Five Cumulative Off-site Watershed Effects Analysis, USDA 1988c). The model primarily looks at vegetation management activities that put soils and water quality at risk through removal of ground cover, soil compaction and disturbance at several hundred to thousands of acres. The model takes into account up to 25 years of past projects plus present and future foreseeable activities. Future seeable activities not associated with this project are 154 acres of underburn and the construct a trail adjacent to the project area by the Forest Service in the subwatershed. Based on the proposed action, future foreseeable activities, previous analysis done and professional judgement the subwatershed is well below the threshold of concern. Due to the type of manual treatments (includes the use of hand tools) proposed, the scale of the project does not warrant the need to run the ERA model and will not be used for this analysis.

Instead pounds of chemical applied and acres treated with chemicals will be the measure used for cumulative watershed effects. Yuba County maintains records on an annual basis of commercial spraying (i.e. private timberland) and reports to the California Department of Pesticides. They don’t include all levels of chemical application (small landowners, residences, etc.). These records nevertheless can be used as basis of comparison between alternatives and other large scale spraying to better assess total use on a watershed scale.

Hydrology and Soil Effects Data Sources

- Forest Service GIS layers of the following: Proposed action boundary, project-delineated subwatershed, land ownership, soils, roads, streams, and special aquatic features.
- Forest Service monitoring reports and published literature.

Affected Environment

Watershed Condition

The subwatershed of the project lies just below New Bullards Bar Reservoir. The streams of the subwatershed flow into the North Yuba River. The pour point/outlet of the subwatershed is at the confluence of the Middle Yuba River. At the confluence of these two rivers then becomes the Yuba River. The North Yuba River is on the 303(d) listed for mercury.

Soil Condition

The proposed project lies inside an old quarry that was rehabbed. Soil cover for most of the site is close to 100 percent. At the site several soil textures were taken and it was determined to be loamy sand. The soils at the site are shallow only a few inches thick where then boulders start to impede any further digging. Due to the nature of the site being an abandoned quarry the original soil structure is gone and site productivity is now low.

Environmental Consequences

Alternative A-Proposed Action

Treatment within RCAs and SMZs

The project area has one primary ephemeral stream with one other small ephemeral feeding into it. The main ephemeral stream has had its channel reinforced with boulders. The ephemeral streams don't have any riparian vegetation. No perennial or seasonal/intermittent streams are found within the project analysis area.

According to the SNFPA ROD, RCAs widths may be adjusted at the project level if a landscape analysis has been completed and site-specific RCO analysis demonstrates a need for different widths. The land designation/allocation of RCAs will remain the same except for treatment within these areas would be allowed to address invasive plants. The potential effects of allowing treatment within RCAs are described in the effects analysis and/or RCO analysis. The effects would be addressed across all alternatives through some of the measures listed below.

Based on field conditions and consistency with other projects (Moonlight Fire Area Invasive Plant Treatment Project 2017, Rush Skeleton Weed Project 2016, PG&E Herbicide Vegetation Management Program Transmission Line Right-of-Ways 2015, Storrie and Rich Fire Areas Invasive Plant Treatment Project 2015) that use herbicides on the forest the table below was developed. Table 1 indicates that no buffers are required for the ephemeral streams and road inside ditch on Marysville Road. Specific design standards will still apply to these sites as indicate in Table 2.

Table 1. Herbicide Application and Non-Chemical Treatments within Ephemeral Streams.

Herbicide Active Ingredient	**Ephemeral Streams (Dry washes without riparian vegetation) and Road Inside Ditches**
Aminocyclopyrachlor	No buffer required, unless specified by design features.
Aminopyralid	
Chlorsulfuron	
Clopyralid	
Fluazifop-P-butyl	
Glyphosate	
Imazapyr	
Triclopyr	
Non-Chemical Treatment Methods	
Manual	
Mechanical	

Project Design Features

Projects Design Features (DF) were developed for the Proposed Action. These DF are developed to reduce or eliminate impacts related to analysis issues and affected resources areas, and are incorporated as an integrated part of the Proposed Action.

Table 2. Project Design Standards for Soil and Water Resources.

Design Feature	Soil and Water Design Standards	Purpose of Design Standard	Source of Design Standard
DF-1	Areas with bare soil created by the treatment of noxious weeds would be evaluated for rehabilitation (i.e. reseeding, mulching, etc.)	To ensure that the treatment of noxious weeds is not creating open areas or bare areas for spread of noxious weeds and to protect water quality and riparian habitat.	BMP 5.4: Revegetation of Surface-disturbed Areas (R5-FSHB 2509.22)
DF-2	**Areas outside of ephemeral stream**: If treatment reduces soil cover to less than 50% for a contiguous are of >0.25 acres, then mulching and/or revegetation may be required to minimize erosion and reestablish native vegetation. Only native plant species will be used in revegetation. All mulch and seed material will be certified weed-free. **Areas within 50 feet of ephemeral stream**: If treatment reduces soil cover to less than 70% for a contiguous area of >0.1 acres, then mulching and/or revegetation may be required to minimize erosion and reestablish native vegetation. Only native plant species will be used in revegetation. All mulch and seed material will be certified weed-free.	To ensure that the treatment of noxious weeds is not creating open areas or bare areas for spread of noxious weeds and to protect water quality and riparian habitat.	BMP 5.4: Revegetation of Surface-disturbed Areas (R5-FSHB 2509.22)
DF-3	Herbicide mixing will not occur within 150 feet of the ephemeral stream and inside ditch. The cleaning and disposal of herbicide containers will be done in accordance with Federal, State, and local laws, regulations, and directives.	To reduce risk of contamination of water by accidental spill.	BMP 5.10: Pesticide Soil Contingency Planning (R5-FSHB 2509.22) BMP 5.11: Cleaning and Disposal of Pesticide Containers and Equipment (R5-FSHB 2509.22) National BMP Chem-5: Chemical Handling and Disposal (FS-990a)
DF-4	When applying herbicides with a backpack sprayer all directed spray will be done in a downward direction in accordance to the herbicide's label. This will minimize herbicide drift and confine the herbicide to the drop zone of the individual weed plant being treated.	To control drift within the entire project area especially within sensitive areas and near water.	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22) BMP 5-13: Controlling Pesticide Drift During Spray Application (R5-FSHB 2509.22) National BMP Chem-1: Chemical Use Planning (FS-990a)

Design Feature	Soil and Water Design Standards	Purpose of Design Standard	Source of Design Standard
DF-5	All herbicide application will follow EPA approved label directions in regards to control of drift of herbicides during spraying. These directions have specific wind speeds and air temperatures for application of each herbicide. Applicators will utilize droplet size and spray pressure to insure droplets do not travel outside of the drip line target plant. A colorant would be added to the herbicide mixture prior to spraying. Spray cards may be used to aid in detecting herbicide drift.	To control drift of herbicides onto unintended targets and to minimize risk of surface water contamination.	BMP 5.8: Pesticide Application According to Label Directions and Applicable Legal Requirements (FSHB 2509.22) BMP 5.9: Pesticide Application Monitoring and Evaluation (R5-FSHB 2509.22) BMP 5.13: Controlling Pesticide Drift during Spray Application (R5-FSHB 2509.22) National BMP Chem-2: Chemical Use Planning (FS-990a)
DF-6	POEA surfactants will not be used within 150 feet of live waters.	To protect aquatic organisms.	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22)
DF-7	Roadside ditches will be treated the same as the water body type they resemble.	To project water quality and meet SNFPA Riparian Management Objectives. Also to ensure that TECS and Special Interest plants are protected.	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22)
DF-8	Application of Aminocyclopyrachlor, and Imazapyr will be limited to late spring and early summer. No application of these chemicals after that timeframe.	To project water quality.	National BMP Chem-1: Chemical Use Planning (FS-990a)
DF-9	Application Chlorsulfuron and Clopyralid will not be allowed in the fall.	To protect water quality.	National BMP Chem-1: Chemical Use Planning (FS-990a)

Hydrology (Water Resources)

Alternative A-Proposed Action

Direct and Indirect Effects of Manual Treatments

Manual treatments to remove invasive plants include digging, hand pulling, chipping, mulching, or tarping. The use of manual tools to pull and cut the invasive plants are considered manual treatment as well. These manual treatments could reduce soil cover but the reduction would be expected to be minimal. In the event of potential small localized erosion and subsequent sediment input to the ephemeral streams. The effects would be transitory and too small to measure. DF-1 and DF-2 listed in Table 2 would fix the localized erosion.

Pulling invasive plants along the stream banks could also destabilize the banks in localized areas. In general, invasive plants provide very little stabilization for stream channels. Any localized effects would be expected to last only a season until vegetation becomes reestablished at these sites. Modification of soil cover can change the timing of runoff, but given the size of the treatment and type of streams, any changes would be transitory and too small to measure.

Cumulative Effects of Manual Treatments

The project area is 24 acres which is 2% of the subwatershed. Not every part of the project area will be treated all at once nor will the area become bare to the point where significant erosion and surface runoff would affect water quality. Project design features identified in Table 2 indicate what to do if soil cover requirements are not met. Risk for cumulative effects for water resources as a result of manual treatment of invasive plants would be extremely low with this project.

Direct and Indirect Effects of Chemical Treatments

The possible routes by which herbicides may contaminate water would be direct application, drift into streams from spraying, runoff form large rain event soon after application, and leaching through the soil into ground water or into a stream. This section addresses each of these delivery routes. No direct application of herbicide to water is proposed for this project. General characteristics for the proposed herbicides are displayed in Table 3. These were compiled from the label information and SERA Risk Assessments.

Table 3. Herbicide Behavior in soils and water.

Chemical	Environmental Fate and Hazards	Leaching Potential	Runoff Potential	Soil Half-life (days)
Aminocyclopyrachlor	Degrades primarily via photolysis. Low binding strength to soils.	High	High	114-433
Aminopyralid	Degrades rapidly in water. Relatively stable in soils. Non-toxic to soil microorganisms.	Low	Low	20-32
Chlorsulfuron	Mobile in soil and may leach and contaminate groundwater. Degrades rapidly in water.	High	Low	40
Clopyralid	Does not bind strongly to soils, and has the potential to be highly mobile in soils especially sandy soils. Degrades primarily by microbial activity in soil and it's relatively rapid. Dry conditions are preferred for effective treatment.	High	Low	20-40
Fluazifop-P-butyl	Degrades rapidly in water and moist soils. Non-toxic to soil microorganisms. Dry conditions are preferred for effective treatment.	Low	Low	21
Glyphosate	Adsorbs tightly to soils. Subject to rapid microbial degradation. Non-toxic to soil microorganisms. Low drift potential.	Low	Low	47
Imazapyr	Moderately persists in soils and has a low degradation. Slight potential for longer-term effects on soil microorganisms at high application rates	Low	Low	25-145
Triclopyr	Weakly bound to soils. Potential for off-site movement through drift, runoff, and wind erosion. Relatively non-toxic to soil organisms.	Low	Moderate	46

The eight herbicides would be used with adjuvants such as surfactants which break up the surface tension of the herbicide and increase the ability for plants to absorb the herbicide. Since any surfactants used would be mixed as a small percentage of an herbicide, the effects on the environment, including soils and water quality would the same as the herbicide (Bakke 2007). Dyes would be used in the herbicide application to identify areas treated and reduce the chance of misdirection spray. Dyes or similar biodegradable colorant to facilitate visual control are water soluble dye and contains no listed hazardous chemicals. They are considered virtually non-toxic to humans (Bakke 2007). For the remainder of this analysis, the discussion of effects resulting from herbicide application takes into consideration the effects of herbicides active and inert ingredients, metabolites, surfactant, and marker dye.

Aminocyclopyrachlor is a persistent compound that will degrade primarily via photolysis post application. It slowly degrades by aerobic microbial metabolism with half-lives ranging from 114-433 days in soils and 29-168 days in water. It is stable to degradation via other pathways. Aminocyclopyrachlor is also expected to be highly mobile in the environment. This product may impact surface water quality due to runoff of rainwater. This is especially true for poorly draining soils and soils with shallow ground water. However, the project site has soils that drain well so runoff potential is lower. This product is classified as having high potential for reaching surface water via runoff for several months after application. DF-8 listed in Table 2 is limits the application of aminocyclopyrachlor to late spring and early summer to maximize the days for the chemicals to degrade as well as minimize leaching and runoff potential. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

Chlorsulfuron and clopyralid are both considered to have a high potential for leaching. Both chemicals are mobile in soils in particular clopyralid is especially mobile in sandy soils which the project does have. Both chemicals have a range up to 40 days for their half-life in soils plus considering the high leaching potential DF-9 was developed to restrict that application of these chemicals in the fall. The purpose of this design feature to protect water quality.

Imazapyr moderately persists in soils and has a low degradation. Slight potential for longer-term effects on soil microorganisms at high application rates. Due to long soil half-life of imazapyr the application of the chemical will be restricted to only the late spring and early summer in order to maximize the number of days for the chemical to degrade. DF-8 listed in Table 2 will apply to imazapyr.

The rest of the herbicides are described briefly in Table 3. Herbicides may reach the ephemeral stream if they are carried away to surface waters by runoff from a rain storm. All the proposed herbicides have low runoff potential with the exception of Aminocyclopyrachlor and Triclopyr. The design features listed in Table 2 were designed to account for herbicides active chemical varying properties and minimize its potential affect to water quality. For example DF-8 and DF-9 were designed to give specific timeframes in which the chemicals are allowed to be applied. BMPs will be incorporated into the project to protect water quality. BMP 5.10 requires a spill contingency plan consisting of predetermined actions to be taken in the event of a spill. Water contamination resulting from cleaning or disposal of pesticide containers would be prevented (BMP 5.11). Lastly, BMP 5.13 minimizes the risk of pesticide falling directly into water, or non-target areas from drifting during spray application.

These BMPs and DFs would effectively diminish the possibility of off-site transport via runoff and limit herbicides from entering surface waters through overland flow. Therefore, the proposed treatments with chemicals and its metabolites are not expected to accumulate or negatively affect water quality in the project area or downstream.

Water Quality Monitoring Studies

The results of fifteen separate water monitoring reports written by hydrologists and geologists on Region 5 forests were summarized in a paper entitled “A Review and Assessment of the Results of Water Monitoring for Herbicide Residues For The Years 1991 to 1999” (Bakke 2001). These reports documented the results of over 800 surface- and ground-water samples taken for reforestation and invasive plant treatment projects that used three herbicides (glyphosate, hexazinone, and triclopyr).

Glyphosate was used on four Forest on eight projects and monitoring samples were collected from 1991-2000. All the projects had various buffers, one projects buffer was as small as 10 feet and it was found that all post-treatment water samples had non-detectable levels of Glyphosate except for one project. One project on the Angeles National Forest had one detection sample out of 13, 15 parts per billion (ppb) which below any level of concern for human health or aquatic resources (Bakke 2001).

Triclopyr was used on five projects on three Forests. Where Triclopyr was used with buffers of 10 to 15 feet, there were three projects where detections occurred. The levels of detection ranged between 0.1 to 1 ppb where specified. One detection of 82 ppb was determined to be from not establishing a buffer on an ephemeral channel. The other detection was on a project with buffers of 10 feet; it had detection during winter storms of 0.63 parts per million (ppm) and 0.6-0.7 ppm. Another project with buffers of 15 feet had a single detection of 1 ppb (Bakke 2001). These detections are considered low and below toxicity levels for aquatic species. To be toxic for the rainbow trout for instance, would require a 96 hour exposure at 117ppm, not ppb. Triclopyr has been shown to have a half-life of 1.3 days in river water (Ganapathy 1997).

Cumulative Watershed Affects Analysis

Management activities and actions on neighboring lands may contribute to the spread of invasive plants on National Forest lands, and vice versa. The exact amount herbicide being applied on other lands outside of Forest Service lands at times is hard to pin point. The 2015 record is the most current year available from the California Department of Pesticides. The data is specified by township, range, and section so the numbers reported may or may not fall within the project's watershed analysis area. The total pounds of chemical applied on private timberland and agriculture was 202.0 on 203.8 acres. If you exclude the application of strychnine which is the active ingredient in gopher grain bait then the total pounds of chemical applied were 202.0 on 147.8 acres. See Figure 1 and Table 4 for location where each chemical was applied and how much. Future spraying may not occur in the same locations and with varying amounts of chemicals used.

Table 5 displays the application rate of each herbicide's active ingredient (lbs. /ac) by what invasive species may be treated with and total acres treated in a single application. The table displays the pounds of chemical applied in one single treatment for each herbicide (chemical). It's hard to predict how much of each chemical will be used at a given point because the amount of proposed chemicals. The purpose of analyzing for all these chemicals to ensure adaptive management is feasible to eradicate and/or control these invasive plants. Not all these chemicals will be applied at the same time to treat the same invasive plants. The amount and frequency of herbicide application will be at its highest within the first 2 years of project implementation. The herbicides will be will be applied no more than twice a year. The amount of acres treated and chemical used (lbs. /acre) will decrease over time as the invasive plants are eradicated and/or controlled.

Applying herbicides at the typical and not maximum recommended rates will also limit the amount of excess residue present on site each year, while the presence of soil microbes and soil temperatures conducive to degrading the herbicides will limit the amount of accumulation. To address these uncertainties and help maintain little to no cumulative effect to the watershed analysis area and to beneficial users downstream, implementation of design features, BMPs, and project monitoring identified in the water quality monitoring plan are essential. It is expect that the said components of the project would provide sideboards maintaining little to no cumulative effects to water and soils.

Figure 1. Locations where Pounds of Chemical Applied and Acres Treated on Private

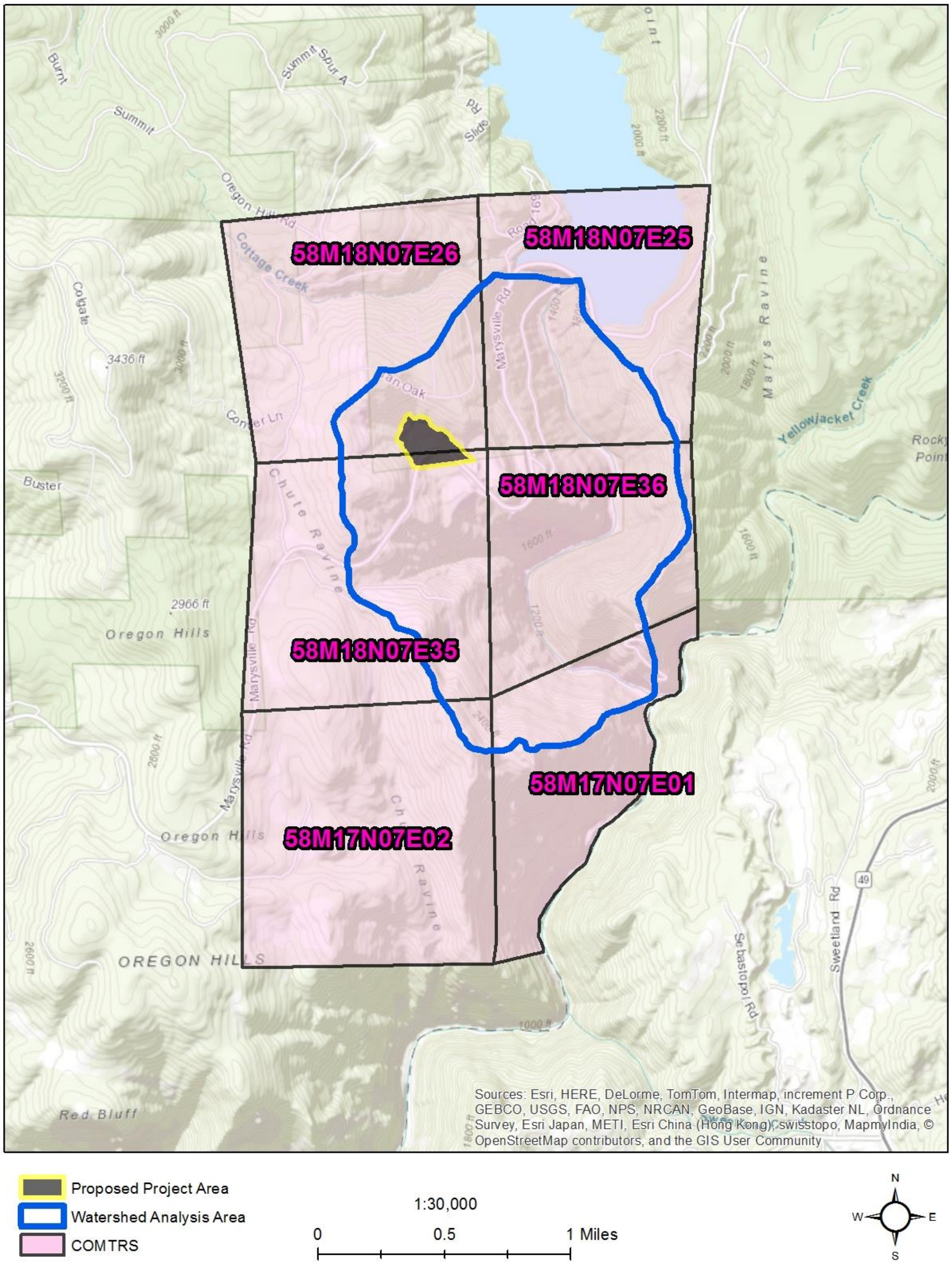

Table 4. Pounds of Chemical Applied and Acres Treated on Private

COMTRS*	Chemical Name	Pounds of Chemical Applied**	Acres Treated
58M18N07E26	Glyphosate	187.9	67.8
58M18N07E35	Triclopyr	8.3	20.0
58M18N07E35	Imazapyr	5.8	60.0
58M18N07E35	Strychnine	0.02	56.0
Total with Strychnine		202.0	203.8
Total without Strychnine		202.0	147.8

*COunty, Meridian, Township, Range, Section
**Pounds of Active Ingredient

Table 5. Pounds of Chemical Applied and Acres Treated at Project Site

Chemical	Upper Application Rate of Active Ingredient (lbs./ac)	Invasive Species and Acreage						Acres Treated at One Time*	Pounds of Chemical Applied**
		Italian Thistle	*Scotch Broom*	*Skeleton Weed*	*Yellow Star-Thistle*	*Barbed Goatgrass*	*Medusahead*		
		0.3	1.9	16.5	16.8	1.4	0.5		
Aminocyclopyrachlor	0.19			X				16.5	3.1
Aminopyralid	0.078	X		X	X			17.1	1.3
Chlorsulfuron	0.08			X				16.5	1.3
Clopyralid	0.2	X		X	X			17.1	3.4
Fluazifop-P-butyl	0.1					X	X	1.9	0.2
Glyphosate	2		X					1.9	3.8
Imazapyr	0.45					X	X	1.9	0.9
Triclopyr	1.12	X	X	X	X			17.7	19.8

*Treatment acres account for overlap of chemical application
**Pounds of chemical applied as one treatment.

Alternative B-No Action

Direct and Indirect Effects of Manual Treatments

There would be no direct and indirect effects in choosing the no action alternative.

Cumulative Effects of Manual Treatments

There would be no cumulative effects in choosing the no action alternative.

Direct and Indirect Effects of Chemical Treatments

There would be no direct and indirect effects in choosing the not action alternative because no chemical treatments would occur.

Cumulative Watershed Affects Analysis

Under this no action alternative, no application of herbicides would occur for the project to treat invasive species. Therefore no pounds of chemical applied and acres treated with chemicals would occur. The potential for herbicides to reach the ephemeral streams would not occur. Lack of treatment will allow the invasive species to continue to spread. Use of herbicide treatments on private and other public lands will continue. Direct and indirect effects from these treatments are insignificant and temporary that treatment under the no action alternative does not contribute to significant cumulative effects.

Soils

Alternative A-Proposed Action

Direct and Indirect Effects of Manual Treatments

A form of soil productivity is the soils ability to support plant growth. The support of plant growth is defined as the soils ability to store "water, nutrients, and provides favorable habitat for soil organisms which cycle nutrients. Chemical, physical, and biological soil processes sustain plant growth which provides forage, fiber, wildlife habitat, and protective cover for watershed protection" (USDA Forest Service 2010). Soil cover is a surrogate for soil productivity.

Soil cover consists of duff and litter, small woody debris, surface rocks, and living vegetation which protect soil particles form displacement and subsequent transport by water or wind. Percent soil cover is a major determining site factor for assessing water erosion hazard in the United States Forest Service (USFS) Region 5 Erosion Hazard Rating (USDA 1990). The 1988 LRMP (USDA Forest Service 1988) establishes standards and guidelines to prevent significant or permanent impairment of soil productivity, including suggesting minimum percent soil cover for set soil Erosion Hazard Ratings (EHR). For the project the soil EHR was determined to be moderate which means the projects soil cover is 50 percent. Field visits to the project area determined that percent soil cover is well above 50 percent. Determining the percent decrease in soil cover post treatments is hard to determine but it is not expected that soil cover will fall below 50 percent. However, if soil cover does fall below 50 percent in a continuous area greater than 0.25 acre then the site would be addressed by DF-2 where soil cover would be increased via mulching and/or revegetation. If invasive plant treatments cause bare soil then the site will be evaluated for rehabilitation as indicated by DF-1 in Table 2. Manual treatments on invasive plants is expected to decrease percent soil cover but is not expected to be significant to cause erosion. The aforementioned DF-1 and DF-2 are in place to minimize the potential of soil erosion.

Cumulative Effects of Manual Treatments

No cumulative effects to soils are expected by the manual treatment of the invasive plants.

Direct and Indirect Effects of Chemical Treatments

Aminocyclopyrachlor will only be applied in the late spring to early summer to maximize the days for the chemicals to degrade as well as minimize leaching and runoff potential. Aminocyclopyrachlor slowly degrades by aerobic microbial metabolism with half-lives ranging from 114-433 days in soils and 29-168 days in water.

Aminopyralid is quite soluble, and its persistence in soil can vary depending on soil type and other environmental conditions. Its half-life in water can range from 0.6 to 990 days and 20 to 60 days in soil with minimal leaching potential below 15 to 30 cm soil depth. Although aminopyralid does not bind readily in soil, it dissipates rapidly in some common soil conditions. No known metabolites of aminopyralid have been identified (SERA, 2007). The projected maximum concentrations of aminopyralid under the proposed application rate would be far below potentially toxic levels on soil micro-organisms. A 2007 study by McMurray showed modest increases in nitrate and total mineral nitrogen concentrations in soil directly following application but no statistically significant effects were noted thereafter (McMurray, 2002). The information on soil-micro-organisms is limited and consists only of a no-observed-effect concentration (NOEC) value for earthworms reported as 5,000 ppm (mg a.e./kg soil). The proposed maximum application rate of 0.1 lbs a.e./acre corresponds to a concentration of about 0.05 ppm and "indicates inconsequential risks to earthworms" (SERA, 2007). Consequently, this information does not provide any basis for asserting that adverse effects on soil-micro-organisms are plausible.

Chlorsulfuron is susceptible to being highly mobile in the environment depending upon soil type. Mobility also usually increases with increasing soil pH and decreasing organic matter. It will move in any direction in the soil profile depending upon water flow. However, it is not expected to cause ground water contamination problems due to its relatively rapid degradation in plants and soils, low use rates and low toxicity.

Clopyralid is relatively persistent in soil, water, and vegetation. It is degraded almost entirely by soil microbes and is not susceptible to photo or chemical degradation. Once clopyralid is applied to soils, it rapidly disassociates (Shang and Arshad 1998), becoming extremely soluble in water, and does not bind strongly with soil particles. Lack of adsorption means that clopyralid has the potential to be mobile and could contaminate ground and surface water via leaching and surface and sub-surface water flows (Tu *et al*. 2001).

Fluazifop-p-butyl is rapidly hydrolyzed to fluazifop acid in vegetation, soils, and water. In soils and water, both the ester and acid forms are metabolized by soil or sediment microbes, and broken-down to herbicidally inactive compounds. The average soil half-life of the ester form is one to two weeks. Fluazifop-p-butylbinds readily with soil particles, limiting leaching and soil runoff (Tu *et al*. 2001).

Glyphosate binds readily with soil particles, which limits its movement in the environment (Tu *et al*. 2001). Therefore has little potential for leaching or runoff due to its very high adsorption to soils. Glyphosate rapidly and tightly binds to soil. There is little potential for leaching or runoff due to its very high adsorption to soil. As a result, glyphosate becomes inactive as an herbicide upon contact with the soil. Glyphosate is degraded via microbial activity. It has a half-life of 47 days (NPIC 2010).

Imazapyr is weakly bound to soil, adsorption increase as organic matter and clay content increase. Imazaypyr is moderately persistent in soil, but not prone to leaching. In tests in forest soils it did not leach or runoff. The half-life of imazapyr ranges from 25 to 145 days. Microbial degradation is the primary means of dissipation (SERA 2011b).

Triclopyr was reported to have a field half-life of 40 to 46 days in soil, a water solubility rating that ranges from 440 to 8,220 mg/L, and an intermediate to minimal leaching potential. Triclopyr appears to variably persist in soil, with minimal mobility and minimal leaching evident in field studies. Triclopyr is adsorbed primarily to organic matter particles in soil. The organic matter content is the primary factor in the degree of soil adsorption and is not characterized as strong (SERA, 2011). Toxicity data on soil-micro-organisms is limited with triclopyr. The projected maximum concentrations under the proposed application rates would be far below potentially toxic levels, therefore the potential for substantial effects on soil-micro-organisms appear to be low (SERA 2011).

The degree to which soil cover decreases as a result of chemical application is hard to predict. However, design features are in place to mitigate any significant soil cover loss in DF-1 and DF-2. The level of soil cover is a proxy for the level of organic material that can absorb applied herbicides. Thus, the soil cover works to lessen herbicide runoff and adsorption for decomposition by soil microbes – the main fate for herbicides (Bollag and Liu 1990).

Most of the proposed herbicides decay primarily by soil microbes. Soil microbial activity increases with temperature such as during the summer months. The application of herbicides may occur in the spring time to be more effective in eradicating or controlling the targeted invasive plants. Overall, the proposed herbicides and application rates would be low enough to facilitate decay by soil microbes (SERA 2004a, 2004b, 2007, 2011a, 2011b, 2011c, 2012, 2014). The proposed herbicide usage would have a low risk for soils since the bulk of treatments will occur in the old quarry site where soils are unproductive and soil communities are uniform. The potential for adverse effects of herbicide residues in soil would be minimized or eliminated by incorporating the project design features (Table 2) and applying BMPs. Project design features include applying herbicides following strict protocols, spill contingency plans, proper disposal of containers and cleaning equipment, and timeframes when to apply or not apply herbicides. No significant direct and indirect effects are expected with the use of herbicides to treat invasive plants as discussed above.

Cumulative Effects of Chemical Treatments

Due to the application rates and project design features, direct and indirect effects would be minimal or negligible. Consequently, there would be very little risk of any cumulative effects to soils at the project site.

Alternative B-No Action

Direct and Indirect Effects of Manual Treatments

Effective soil cover will remain the same as its existing condition which is well above 50 percent. Soil microbial activity will not change since no treatment would occur and soil productivity would remain the same. Everything will remain the same therefore there would be no changes to the soil function of the project area. However, invasive plants would continue to out-complete native species which in the long-term will change the plant/soil community.

Cumulative Effects of Manual Treatments

Under this no action alternative, no manual treatments would occur for the project to treat invasive species and no cumulative effects would occur.

Direct and Indirect Effects of Chemical Treatments

Under this no action alternative, no chemical treatments would occur for the project to treat invasive species therefore no direct and indirect effects would occur.

Cumulative Effects of Chemical Treatments

Under this no action alternative, no chemical treatments would occur for the project to treat invasive species therefore no cumulative effects would occur.

Compliance with the Forest Plan and Other Direction

The Forest Service is complying with management direction, regulations, and pertinent laws as it pertains to the project.

Clean Water Act

Section 208 of the Clean Water Act requires states to prepare non-point source pollution plans, which were to be certified by the State and approved by the Environmental Protection Agency (EPA). In response to this law and in coordination with the State of California Water Resources Control Board (SWRCB) and EPA, Region 5 began developing Best Management Practices (BMPs) for water quality management planning on National Forest System lands within the State of California in 1975.

The Storrie IPT project meets the Clean Water Act by implementing the Best Management Practices of the Soil and Water Conservation Handbook (USDA 2011a). By adhering to BMPs, the Storrie IPT Project meets this Act according to the SNFPA ROD (USDA 2004b, Section VII).

The BMPs that are pertinent to the proposed project activities are included in this project to protect beneficial uses of water (Appendix A). Project design features offer additional protection and include acreage caps for chemical treatment by all entities in the 150 feet buffer around the major rivers to prevent the risk of cumulative effects to water quality.

State of California Water Resources Control Board Resolution #68-16 (CRWQCB 1968) directs that high quality water or water of higher quality than required by regulation be maintained at that higher quality. Similarly, anti-degradation EPA policy 40 C.F. R. Section 131.12 states that existing water quality, even when it exceeds required levels for stated beneficial uses, will be maintained. Potential effects of the proposed action, either through surface runoff of sediment and chemicals or chemicals entering water bodies through groundwater sources, do not constitute a significant degradation of quality or impair existing beneficial uses.

A water quality monitoring plan is included to ensure the effectiveness of BMPs and design features, and allow for adaptive management if any detrimental effects are detected.

Sierra Nevada Framework

In addition to the BMPs additional project design features are also included to ensure that the riparian conservation objectives (RCOs) are met for work proposed in the riparian conservation areas. Relevant RCOs include:

Riparian Conservation Objective #1: Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.

Riparian Conservation Objective #4: Ensure that management activities, including fuels reduction actions, within RCAs and Critical Aquatic Refuges (CARs) enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.

As stated throughout this analysis, the relatively small areas of treatment, protection measures including bare soil mitigations, timeframes when to apply and not apply specific herbicides, and adherence to BMPs will ensure that beneficial uses are adequately protected.

Small, short-term, negative effects that may occur to RCA areas because of the removal of vegetation would be more than offset by mitigation measures and the long term benefits of returning vegetation communities back to a more desirable condition.

Plumas National Forest Land and Resource Management Plan (LRMP)

BMPs and project design features (Table 2) will also ensure compliance with the PNF LRMP (USDA 1988a).

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